1946). Eventually the members or their offspring may be swept again into the current system. It seems quite possible that the Monterey canyon contains, or did contain at the time that the collections were made, an eddy of this nature. But even there the nemertean population was far from dense considering the vast volume of water which passed through so many nets.

A similar intensive search has been made by Dr. William Beebe in the Atlantic near Bermuda, where nets 1 meter in diameter were drawn several hundred times at the appropriate depths through a circular area eight miles in diameter. There likewise, as reported by Coe (1945), a total of 14 species of bathypelagic nemerteans was found during the summers of 1929, 1930, and 1931, but it is uncertain whether these two examples with similar results indicate more or less permanent local populations or whether the captured individuals were drifting past those localities at the precise times when the nets were lowered to catch them. The hydrographic data indicate water movements of considerable magnitude at the depths at which the nemerteans were obtained.

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ZOOLOGY.—*A new species of the genus* Diarthrodes (*Crustacea, Copepoda*) *parasitic in a red alga.*[1] Wolf-Henrich Fahrenbach, University of California. (Communicated by Fenner A. Chace, Jr.).

In 1891 E. S. Barton described a curious phenomenon in which the copepod *Harpacticus chelifer* developed in the thallus of a red alga, *Rhodymenia palmata*, forming galls up to 1 mm in diameter. A similar relationship has been observed between a new species of the genus *Diarthrodes* and the red alga *Halosaccion glandiforme*. This species also represents the first reported occurrence of the genus on the west coast of North America.

In the systematic outline below the work of Lang (1948) has been followed throughout.

Order Copepoda
Tribe Harpacticoida
Family Thalestridae
Subfamily Dactylopodiinae
Genus **Diarthrodes** Thomson, 1882

Diagnosis.—Body pyriform. Epimeral plates of at least thoracic segments well developed. Rostrum not set off, directed downward. Antennule in ♀ 5–8 jointed. Exopodite of antenna 1–3 jointed. Base of mandible with 1–2 bristles (?). Exopodite of maxilla represented by 1 bristle. Exopodite of first leg not clasping, 1–2 jointed, much shorter than 3-jointed clasping endopodite. Armature of swimming legs differing somewhat from species to species. Exopodite of fifth leg in ♀ with 4–6 bristles; same for basoendopodite.

[1] I am indebted to Dr. Cadet Hand for suggesting the problem as well as helpful advice and constructive criticism.

Diarthrodes cystoecus, n. sp. (Fig. 1)

Description.—The rostrum (Fig. 9) is pointed, its anterior edges being slightly concave. It is not longer than the width of the antennule and, therefore, usually hidden in side view.

The antennule (Fig. 2) is 8-jointed, the eighth, most distal, joint possibly being the expanded terminal bristle bases. All joints with exception of the first have at least 1 bristle at their distal borders. The third joint has three dorsal bristles, the fourth two long bristles at its distal edge, extending almost as far as the tip of the four terminal bristles.

The antenna (Fig. 3) is 3-jointed, with six terminal dorsally-bent bristles. Its exopodite is 3-jointed, each joint having a stiff lateral spine and the third joint an additional terminal spine.

The tapering subchela of the maxilliped (Fig. 4) has a long, slender dactylopodite and a thin bristle of at least the length of the dactylopodite emerging from the proximal portion of the hand.

The endopodite of the first leg (Fig. 5) is 3-jointed, about twice as long as the 2-jointed exopodite, with its terminal claw being hooked and more than twice as long as the subterminal claw on the third joint. The medial bristle of the first joint of the endopodite is slightly proximal to the middle of the joint. The first joint of the exopodite has one and the second joint three heavy spines, the terminal one being as long or longer than the first and second joint combined.

The endopodite and exopodite of the second leg (first swimming leg, Fig. 6) are 3-jointed, the first and second joints of the exopodite having one spine each, the third joint three spines. In addition the second joint of the exopodite has one and the third joint four long, stout bristles. The endopodite has one spine on the first and one on the third joint plus two and four long bristles on the second and third joint, respectively.

The two other pairs of swimming legs also show the characteristic heavy spine armature of the exopodite. The fifth leg (Fig. 7) has four bristles on each side of the basoendopodite, one of these being external to the exopodite. The exopodite has five bristles, the second one counted from the medial side being more than three times the length of the exopodite.

Diagnosis.—A.1 8 jointed (?). Exp. A.2 3-jointed with one bristle on first, one on second and two on third joint. Exp. P.1 2-jointed, Enp. P.1 3-jointed, medial bristle of first joint slightly proximal to middle. Exp. and Enp. P.2 3-jointed.

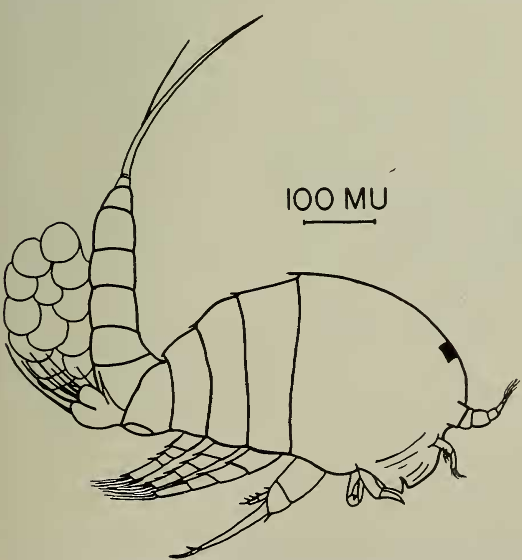

Fig. 1.—*Diarthrodes cystoecus*, n. sp., mature female.

Exp. P.5 oval, about one-third longer than wide, with five bristles. Benp. with four bristles.

Color: Ruby-red, with conspicuous deep-red sparkling nauplius eye in life.

Dimensions: 0.5–0.8 mm long, 0.18–0.20 mm wide.

Type locality: Moss Beach, San Mateo County, Calif.

Type specimen: U. S. N. M. no. 96364 (♀).

Methods.—A new staining technique (after Mazia et al., 1953) was used with excellent results. The protein stain, mercury-bromphenol blue, can be used on any material not fixed in osmium containing fixatives. The copepods were transferred to the stain (10g $HgCl_2$ and 100 mg brom-phenol blue per 100 ml H_2O) for 15–20 minutes, then passed into a buffer of pH 6.4 (79.9 g $K_2HPO_4 \cdot H_2O$, 61.2 g KH_2PO_4, 1000 ml H_2O). While the buffer effects an immediate blueing and subsequently extracts the stain, the process can be stopped, when the desired intensity has been reached, by changing to alcohol. The result is a dense blue stain in the bristles and muscles.

Discussion.—The presence of males could not be ascertained, i.e., there have not been found any obvious structural differences between ovigerous females and other animals without egg sacs. A possible separating characteristic could be the length of the bristles of the fifth leg, although such variations and intergradations were found that I am unable to make any definite decision.

Although ecology and mode of reproduction are practically unknown for all 19 species in this genus, the few sparse bits of information almost all agree that the habitat for the genus, wherever found, is in the "zone of red algae" and "littoral zone" (Lang, 1948).

Diarthrodes cystoecus seems to be able to complete its life cycle in the same alga. Large numbers of ovigerous females are found in the organic and silty sediment inside the water-filled, bladder-like thalli of the red alga *Halosaccion glandiforme.* This alga occurs in great abundance between the 2.5′ and 1.0′ tidal level at the type locality.

The young nauplii burrow into the inside wall of the bladder. One such six-legged nauplius was found a few cells deep under the inside surface. The area of perforation was whitish and firm, apparently noncellular. As the animal grows a cyst is produced, projecting about 1 mm above the external surface, with a diameter up to 1.5

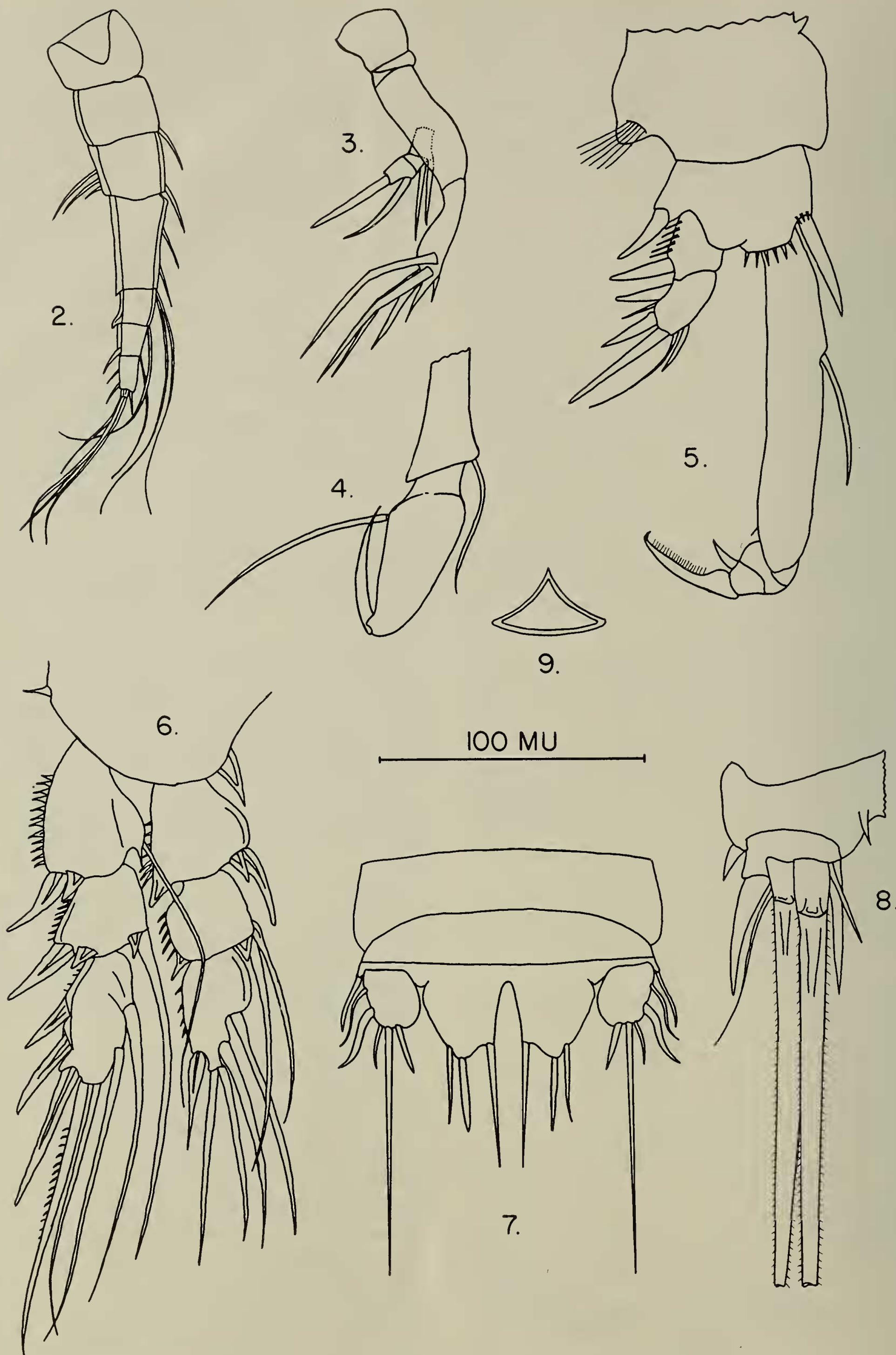

FIG. 2–9.—*Diarthrodes cystoecus*, n. sp.: 2, Antennule; 3, antenna; 4, maxilliped; 5, first leg; 6, second leg (first swimming leg); 7, fifth leg, dorsal view; 8, caudal ramus, dorsal view; 9, rostrum.

mm. On the inside there is a corresponding very slight protuberance, becoming more conspicuous and transparent as the animal grows and, finally, showing a perforation. In this stage ovigerous females were found tightly wedged in the central cavity of the cyst. Later, the perforation becomes larger and the animal is liberated into the inside of the bladder. Since most bladders have areas eroded open to the exterior, the copepods, which tend to crawl by means of their swimming legs on the surface of the alga, probably infect neighboring plants.

No attempt has been made in this study to determine the mode of reproduction, whether parthenogenetic or, possibly, by external fertilization.

About 70–80 percent of the algae at the type locality were infected. Considering the degree of infection in individual thalli there seems to be an "all or none" effect, i.e., thalli are either free from copepods or are infected to a high degree. In one instance, 33 cysts per cm^2 were counted. It seems plausible that a population in a young frond, having very few perforations, is relatively confined and multiplies rapidly. This heavy infection in most cases leads to extensive perforations of the bladder.

The habitat in the alga, as described here, is a truly admirable one. The bladders hold water for a long time, even if exposed, or stay moist due to their relatively fleshy walls. Furthermore, there does not seem to be any predator of any consequence in or on the algae.

The name *cystoecus* (cyst dwelling) suggested itself as the most appropriate one.

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MALACOLOGY.—*A study of the shell structure and mantle epithelium of* Musculium transversum (*Say*).

Samuel W. Rosso, U. S. Navy Hydrographic Office.[1] (Communicated by Willis L. Tressler.)

Musculium transversum (Say) is a member of the family Sphaeriidae, a group of fresh-water bivalves that are worldwide in distribution and are found in lakes, pools, and rivers, where they occupy the shallowest of water and the lower depths of the deepest lakes. Some of the usually accepted characteristics of the Sphaeriidae include the presence of punctae in the shell material and the absence of a prismatic layer as a component of the shell. Previous studies have described the shell as consisting of only the nacreous layer and the periostracum, thereby differing from the other bivalves in which the shell consists of the periostracum, prismatic layer, and the nacreous layer.

This report is mainly concerned with the general shell structure of *M. transversum*, and evidence is presented that shows the presence of a prismatic layer as a natural component of the shell. A gross study of the mantle epithelium is also included, and a correlation of the shell structure with the mantle epithelium is attempted. The pyramidal cells, however, which occupy the punctae or shell canals, are treated lightly, and conclusive evidence as to their function is still lacking.

Schröder (1906–1907) cited Leydig as stating that the shell of *Sphaerium corneum* lacked the prismatic layer, the shell being composed only of the nacreous layer and periostracum. Leydig concluded that the punctae were hollow canals; that they were unbranched and measured 0.024 mm in length and were 0.003 mm wide; and that the mantle epithelium was composed of large cells, 0.007 mm to 0.012 mm, some of which grew into the canals. Leydig surmised that the purpose of the canals was similar to bone and tooth canals in that the purpose is to carry food materials.

[1] The author wishes to express his appreciation to Dr. Ellinor H. Behre, Louisiana State University, under whose direction this work was conducted. Special thanks are also due Dr. Harold Harry, Rev. H. B. Herrington, Dr. J. P. E. Morrison, Dr. H. E. Wheeler, Alan Cheetham, and Jesse West for their advice and assistance.